Airway Management: Part 2

EMS Professions
Temple College
Risks / Protective Measures

- Be prepared for:
  - Coughing
  - Spitting
  - Vomiting
  - Biting

- Body Substance Isolation
  - Gloves
  - Face, eye shields
  - Respirator, if concern for airborne disease
ALS Airway/Ventilation Methods

Gastric Tubes

Nasogastric

- Caution with esophageal disease or facial trauma
- Tolerated by awake patients, but uncomfortable
- Patient can speak
- Interferes with BVM seal

Orogastric

- Usually used in unresponsive patients
- Larger tube may be used
- Safe in facial trauma
ALS Airway/Ventilation Methods

- Nasogastric Tube Insertion
  - Select size (French)
  - Measure length (nose to ear to xiphoid)
  - Lubricate end of tube (water soluble)
  - Maintain aseptic technique
  - Position patient sitting up if possible
ALS Airway/Ventilation Methods

- **Nasogastric Tube Insertion**
  - Insert into nare towards angle of jaw
  - Advance gradually to measured length
  - Have patient swallow
  - Assess placement
    - Instill air, auscultate
    - Aspirate gastric contents
  - Secure
  - May connect to low vacuum (80-100 mm Hg)
Orogastric Tube Insertion

- Select size (French)
- Measure length
- Lubricate end of tube
- Position patient (usually supine)
- Insert into mouth
- Advance gradually but steadily
- Assess placement (instill air or aspirate)
- Secure
- Evacuate contents as needed
ET Introduction

Endotracheal Intubation

- Tube into trachea to provide ventilations using BVM or ventilator
- Sized based upon inside diameter (ID) in mm
- Lengths increase with increased ID (cm markings along length)
- Cuffed vs. Uncuffed
Endotracheal Intubation

Advantages

- Secures airway
- Route for a few medications (LANE)
- Optimizes ventilation, oxygenation
- Allows suctioning of lower airway
Endotracheal Intubation

Indications

- Present or impending respiratory failure
- Apnea
- Unable to protect own airway
Endotracheal Intubation

These are **NOT** Indications

- Because *I* can intubate
- Because *they* are unresponsive
- Because *I* can’t show up at the hospital without it
Endotracheal Intubation

Complications

- Soft tissue trauma/bleeding
- Dental injury
- Laryngeal edema
- Laryngospasm
- Vocal cord injury
- Barotrauma
- Hypoxia
- Aspiration
- Esophageal intubation
- Mainstem bronchus intubation
Endotracheal Intubation

- Insertion Techniques
  - Orotracheal Intubation (Direct Laryngoscopy)
  - Blind Nasotracheal Intubation
  - Digital Intubation
  - Retrograde Intubation
  - Transillumination
Orotracheal Intubation

Technique

- Position, ventilate patient
- Monitor patient
  - ECG
  - Pulse oximeter
- Assess patient’s airway for difficulty
- Assemble, check equipment (suction)
- Hyperventilate patient (30-120 sec)
Orotracheal Intubation

- Position patient
- Open mouth
- Insert laryngoscope blade on right side
- Sweep tongue to left
- Identify anatomical landmarks
- Advance laryngoscope blade
  - Vallecula for curved (Miller) blade
  - Under epiglottis for straight (Miller) blade
ALS Airway/Ventilation Methods

Orotracheal Intubation

- Elevate epiglottis
- Directly with straight (Miller) blade
- Indirectly with curved (Macintosh) blade
- Visualize vocal cords, glottic opening
- Enter mouth with tube from corner of mouth
ALS Airway/Ventilation Methods

atchewan Intubation

- Advance tube into glottic opening about 1/2 inch past vocal cords
- Continue to hold tube, note location
- Ventilate, auscultate
  - Epigastrium
  - Left and right chest
- Inflate cuff until air leak around cuff stops
- Reassess tube placement
ALS Airway/Ventilation Methods

- Orotracheal Intubation
  - Secure tube
  - Reassess tube placement, ventilation effectiveness
Intubation

Total time between ventilations should not exceed 30 seconds!
Intubation

Death occurs from **failure to Ventilate**, not failure to Intubate
ALS Equipment

Equipment

- Laryngoscope Handle (lighted) & Blades
- Stylet
- Syringe
- Magills
- Lubricant
- Suction
- BVM
- BAAM (Blind Nasal)

Selection

- Typical Adult ET Tube Sizes
  - Male - 8.0, 8.5
  - Female - 7.0, 7.5, 8.0
- Blade
  - Mac - 3 or 4
  - Miller - 3
- Tube Depth
  - Usually 20 - 22 cm at the teeth
ALS Equipment
ALS Equipment

From AHA PALS
ALS Equipment

Figure 33: Pediatric Endotracheal Tubes
Pediatric ET Intubation

Pediatric Equipment Differences

- Uncuffed tube < 8 yoa
- Miller blade preferred

Tube Size

- Premie: 2.0, 2.5
- Newborn: 3.0, 3.5
- 1 year: 4
- Then: (age/4)+4

Pediatric Differences

- Anatomic Differences
- Depth (cm)
  - Tube ID x 3
  - 12 + (age/2)
  - easily dislodged

- Intubation vs BVM
Patient Positioning

- Goal
  - Align 3 planes of view, so Vocal cords are most visible
- T - trachea
- P - Pharynx
- O - Oropharynx
FIG. 6.3. A: Anatomic neutral position. The oral (OA), pharyngeal (PA),
and laryngeal (LA) axes are at greater
angles to one another. B: Head, still in
neutral position, has been lifted by a
pillow flexing the lower cervical spine
and aligning the pharyngeal (PA) and
laryngeal (LA) axes. C: The head has
been extended on the cervical spine,
aligning the oral axis (OA) with the
pharyngeal (PA) and laryngeal (LA)
axes, creating the optimum "sniffing"
position for intubation. D: Relatively
anteriorly placed larynx. E: BURP
maneuver on the thyroid cartilage.
F: BURP maneuver improves the
laryngeal view for intubation.
Airway Assessment

- Cervical Spine
- Temporal Mandibular Joint
- A/O Joint
- Neck length, size and muscularity
- Mandibular size in relation to face
- Over bite
- Tongue size
Assessment Acronym

M  Mandible
O  Opening
U  Uvula
T  Teeth
H  Head
S  Silhouette
The Lemon Law

- Look externally
- Evaluate the 3-3-2 rule
- Mallampati score
- Obstruction?
- Neck Mobility
Look

- Morbidly obese
- Facial hair
- Narrow face
- Overbite
- Trauma
Evaluate 3-3-2

- Temporal Mandibular Joint
  - Should allow 3 fingers between incisors
  - 3-4 cm
Evaluate 3-3-2

Mandible

- 3 fingers between mentum & hyoid bone
- Less than three fingers
  - Proportionately large tongue
  - Obstructs visualization of glottic opening
- Greater than three fingers
  - Elongates oral axis
  - More difficult to align the three axis
Evaluate 3-3-2

Larynx
- Adult located C5,6
- If higher, obstructive view of glottic opening
- Two fingers from floor of mouth to thyroid cartilage
Mallampati Score

- Evaluates ability to visualize glottic opening
  - Patient seated with neck extended
  - Open mouth as wide as possible
  - Protrude tongue as far as possible
  - Look at posterior pharynx
  - Grade based on visual field
    - Grades 1,2 have low intubation failure rates
    - Grades 3,4 have higher intubation failure rates
Mallampati Score

- Not useful in emergent situations
- Informal version
  - Use tongue blade to visualize pharynx
Final page of the Medical Boards

BONUS QUESTION:
(50 points)
What's the name of that thing that hangs down in the back of our throats?
Mallampati Grades

Class I  Class II  Class III  Class IV

↑ Difficulty ➔
Obstruction

- Know or suspected
  - Foreign bodies
  - Tumors
  - Abscess
  - Epiglottitis
  - Hematoma
  - Trauma
Neck Mobility

- Align axis to facilitate orotracheal intubation
- Decreased mobility from
  - C-Spine immobilization
  - Rheumatoid arthritis
- Quick Test
  - Put chin on chest then move toward ceiling
Curved Blade (Macintosh)

- Insert from right to left
- Visualize anatomy
- Blade in vallecula
- Lift up and away
  DO NOT PRY ON TEETH
- Lift epiglottis indirectly

From AHA ACLS
Straight Blade (Miller)

- Insert from right to left
- Visualize anatomy
- Blade past vallecula and over epiglottis
- Lift up and away
  **DO NOT PRY ON TEETH**
- Lift epiglottis directly

From AHA ACLS
Glottic Opening

- Cormack-Lehane laryngoscopy grading system
- Grade 1 & 2 low failure rates
- Grade 3 & 4 high failure rates
Tube Placement

Figure 34: Positioning of Endotracheal Tube
Proper ET tube placement in airway
Confirmation of Placement
Placement of the ETT within the esophagus is an accepted complication.

However, failure to recognize and correct is not!
Traditional Methods

- Observation of ETT passing through vocal cords.
- Presence of breath sounds
- Absence of epigastric sounds
- Symmetric rise and fall of chest
- Condensation in ETT
- Chest Radiograph
All of these methods *have* failed in the clinical setting
Additional Methods

- Pulse Oximetry
- Aspiration Techniques
- End Tidal CO$_2$
Confirming ETT Location

- Fail Safe
- Near Fail Safe
- Non-Fail Safe
Fail Safe

- Improvement in Clinical Signs
- ETT visualized between vocal cords
- Fiberoptic visualization of
  - Cartilaginous rings
  - Carina
Near Failsafe

- CO2 detection
- Rapid inflation of EDD
Non-Failsafe

- Presence of breath sounds
- Absence of epigastric sounds
- Absence of gastric distention
- Chest Rise and Fall
- Large Spontaneous Exhaled Tidal Volumes
Non Failsafe

- Condensation in tube disappearing and reappearing with respiration
- Air exiting tube with chest compression
- Bag Valve Mask having the appropriate compliance
- Pressure on suprasternal notch associated with pilot balloon pressure
ALS Airway/Ventilation Methods

- Blind Nasotracheal Intubation
  - Position, oxygenate patient
  - Monitor patient
    - ECG monitor
    - Pulse oximeter
ALS Airway/Ventilation Methods

- Blind Nasotracheal Intubation
  - Assess for difficulty or contraindication
    - Mid-face fractures
    - Possible basilar skull fracture
    - Evidence of nasal obstruction, septal deviation
  - Assemble, check equipment
    - Lubricate end of tube; do not warm
    - Attach BAAM (if available)
ALS Airway/Ventilation Methods

Blind Nasotracheal Intubation
- Position patient (preferably sitting upright)
- Insert tube into largest nare
- Advance slowly, but steadily
- Listen for sound of air movement in tube or whistle via BAAM
- Advance tube
- Assess placement
- Inflate cuff, reassess placement
- Secure, reassess placement
ALS Airway/Ventilation Methods

Digital Intubation
- Blind technique
- Variable probability of success
- Using middle finger to locate epiglottis
- Lift epiglottis
- Slide lubricated tube along index finger
- Assess tube placement/depth as with orotracheal intubation
ALS Airway/Ventilation Methods

Digital Intubation

From AMLS, NAEMT
ALS Airway Ventilation Methods

Surgical Cricothyrotomy

Indications

- Absolute need for definitive airway, AND
  - unable to perform ETT due to structural or anatomic reasons, AND
  - risk of not securing airway is > than surgical airway risk

OR

- Absolute need for definitive airway AND
  - unable to clear an upper airway obstruction, AND
  - multiple unsuccessful attempts at ETT, AND
  - other methods of ventilation do not allow for effective ventilation, respiration
ALS Airway/Ventilation Methods

- Surgical Cricothyrotomy
  - Contraindications (relative)
    - No real demonstrated indication
    - Risks > Benefits
    - Age < 8 years (some say 10, some say 12)
    - Evidence of fractured larynx or cricoid cartilage
    - Evidence of tracheal transection
ALS Airway/Ventilation

Methods

Surgical Cricothyrotomy

Tips

- Know anatomy
- Short incision, avoid inferior trachea
- Incise, do not saw
- Work quickly
- Nothing comes out until something else is in
- Have a plan
- Be prepared with backup plan
ALS Airway/Ventilation Methods

- Needle Cricothyrotomy/Transtracheal Jet Ventilation

  - **Indications**
    - Same as surgical cricothyrotomy with
    - Contraindication for surgical cricothyrotomy

  - **Contraindications**
    - None when demonstrated need
    - Caution with tracheal transection
Jet Ventilation
- Usually requires high-pressure equipment
- Ventilate 1 sec then allow 3-5 sec pause
- Hypercarbia likely
- Temporary: 20-30 mins
- High risk for barotrauma
ALS Airway/Ventilation Methods

Alternative Airways

- Multi-Lumen Devices (CombiTube, PTLA)
- Laryngeal Mask Airway (LMA)
- Esophageal Obturator Airways (EOA, EGTA)
- Lighted Stylets
ALS Airway/Ventilation Methods

Pharyngeal Tracheal Lumen Airway (PTLA)

From AMLS, NAEMT
ALS Airway/ Ventilation Methods

Combitube®

From AMLS, NAEMT
ALS Airway/ Ventilation Methods

✲ Combitube®

▲ Indications

▲ Contraindications

☒ Height
☒ Gag reflex
☒ Ingestion of corrosive or volatile substances
☒ Hx of esophageal disease
ALS Airway/ Ventilation Methods

- Laryngeal Mask Airway (LMA)
  - ↑ use in OR
  - Gaining use out-of-hospital
  - Not useful with high airway pressure
  - Not replacement for endotracheal tube
  - Multiple models, sizes
LMA

Diagram of the larynx showing:
- Soft palate
- Posterior third of tongue
- Epiglottis
- Aryepiglottic fold
- Laryngeal inlet
- Interarytenoid notch
- Thyroid gland
- Esophagus
- Pyriform fossa
- Mucous membrane covering cricoid cartilage
- Upper esophageal sphincter
ALS Airway/ Ventilation Methods
BLS & ALS Airway/ Ventilation Methods

Esophageal Obturator Airway, Esophageal Gastric Tube Airway

- Used less frequently today
- Increased complication rate
- Significant contraindications
  - Patient height
  - Caustic ingestion
  - Esophageal/liver disease

Better alternative airways are now available
Esophageal Gastric Tube Airway (EGTA)

From AHA ACLS
ALS Airway/ Ventilation Methods

- **Lighted Stylette**
  - Not yet widely used
  - Expensive
  - Another method of visual feedback about placement in trachea
Lighted Slyest
ALS Airway/Ventilation Methods
Pharmacologic Assisted Intubation “RSI”

- **Sedation**
  - Reduce anxiety
  - Induce amnesia
  - Depress gag reflex, spontaneous breathing
- **Used for**
  - induction
  - anxious, agitated patient
- **Contraindications**
  - hypersensitivity
  - hypotension
Pharmacologic Assisted Intubation “RSI”

- **Common Medications for Sedation**
  - Benzodiazepines (diazepam, midazolam)
  - Narcotics (fentanyl)
- **Anesthesia Induction Agents**
  - Etomidate
  - Ketamine
  - Propofol (Diprivan®)
Pharmacologic Assisted Intubation

Neuromuscular Blockade

Temporary skeletal muscle paralysis

Indications

When intubation required in patient who:

- is awake,
- has gag reflex, or
- is agitated, combative
Pharmacologic Assisted Intubation

Neuromuscular Blockade

- Contraindications
  - Most are specific to medication
  - Inability to ventilate once paralysis induced

- Advantages
  - Enables provider to intubate patients who otherwise would be difficult, impossible to intubate
  - Minimizes patient resistance to intubation
  - Reduces risk of laryngospasm
Pharmacologic Assisted Intubation

NMB Agent Mechanism of Action

- Acts at neuromuscular junction where ACh normally allows nerve impulse transmission
- Binds to nicotinic receptor sites on skeletal muscle
- Depolarizing or non-depolarizing
- Blocks further action by ACh at receptor sites
- Blocks further depolarization resulting in muscular paralysis
Pharmacologic Assisted Intubation

- Disadvantages/Potential Complications
  - Does not provide sedation, amnesia
  - Provider unable to intubate, ventilate after NMB
  - Aspiration during procedure
  - Difficult to detect motor seizure activity
  - Side effects, adverse effects of specific drugs
Pharmacologic Assisted Intubation

Common Used NMB Agents

- Depolarizing NMB agents
  - succinylcholine (Anectine®)

- Non-depolarizing NMB agents
  - vecuronium (Norcuron®)
  - rocuronium (Zemuron®)
  - pancuronium (Pavulon®)
Pharmacologic Assisted Intubation

SUMMARIZED PROCEDURE

- Prepare all equipment, medications while ventilating patient
- Hyperventilate
- Administer induction/sedation agents and pretreatment meds (e.g. lidocaine or atropine)
- Administer NMB agent
- Sellick maneuver
- Intubate per usual
- Continue NMB and sedation/analgesia prn
Pharmacologic Assisted Intubation

Failure is not an option!
ALS Airway/Ventilation Methods

- Needle Thoracostomy
  
  **Indications**
  - Positive signs/symptoms of tension pneumothorax
  - Cardiac arrest with PEA or asystole with possible tension pneumothorax

  **Contraindications**
  - Absence of indications
ALS Airway/Ventilation Methods

- Tension Pneumothorax Signs/Symptoms
  - Severe respiratory distress
  - or absent lung sounds (usually unilateral)
  - resistance to manual ventilation
  - Cardiovascular collapse (shock)
  - Asymmetric chest expansion
  - Anxiety, restlessness or cyanosis (late)
  - JVD or tracheal deviation (late)
Needle Thoracostomy

- Prepare equipment
  - Large bore angiocath
- Locate landmarks: 2nd intercostal space at midclavicular line
- Insert catheter through chest wall into pleural space over top of 3rd rib (blood vessels, nerves follow inferior rib margin)
- Withdraw needle, secure catheter like impaled object
ALS Airway/Ventilation Methods

Chest Escharotomy

- **Indications**
  - Presence of severe edema to soft tissue of thorax as with circumferential burns
  - Inability to maintain adequate tidal volume, chest expansion even with assisted ventilation

- **Considerations**
  - Must rule out upper airway obstruction
  - Rarely needed
ALS Airway/Ventilation Methods

Chest Escharotomy

Procedure
- Intubate if not already done
- Prepare site, equipment
- Vertical incision to anterior axillary line
- Horizontal incision only if necessary
- Cover, protect
Airway & Ventilation Methods

- Saturday’s class
  - Practice using equipment
    - orotracheal intubation
    - nasotracheal intubation
    - gastric tube insertion
    - surgical airways
    - needle thoracostomy
    - combitube
    - retrograde intubation